

former subject at least, Stokes stands, without a living rival, the great authority. From the *Aberration of Light*, the *Constitution of the Luminiferous Ether*, the full explanation of the singular difficulties presented by *Newton's Rings*, to the grand theoretical and experimental treatise on the *Dynamical Theory of Diffraction*, we have a series of contributions to this branch of optics which, even allowing for improved modern surroundings, will bear comparison with the very best work of Newton, Huyghens, Young, or Fresnel in the same department.

Specially remarkable among the Hydrodynamical papers is that on *Oscillatory Waves*, to which a very important addition has been made in the reprint. The investigation of the "profile" of such a wave is here carried to a degree of approximation never before attempted.

Besides these *classes* of papers we have the very valuable treatise on *Friction of Fluids in Motion, and on the Equilibrium and Motion of Elastic Solids*. This was Stokes' early masterpiece, and it may truly be said to have revolutionized our knowledge on the subjects it treats. To mention only one point, though an exceedingly important one, it was here that for the first time was clearly shown the error of assuming any *necessary* relation between the rigidity and the compressibility of an elastic solid, such as had been arrived at from various points of view by the great Continental mathematicians of the earlier part of the present century.

Of the few purely mathematical papers in the present volumes the most important is the well-known examination of the *Critical Values of the Sums of Periodic Series*, a subject constantly forced on the physicist whenever he has to treat a case of discontinuity.

We need not say that the printing of these volumes is all that could be desired: the name of the Pitt Press is a sufficient guarantee. But the introduction, for the first time, of a *solidus* to save "spacing" and space in the printing of mathematical formulæ, was a bold step on the part of Prof. Stokes:—since amply justified by the testimony of the readers of the first of these volumes, and still more by its almost immediate adoption by thoroughly scientific as well as practical men, such as the Editors of what we still feel inclined to call by the well-known name of *Poggendorff's Annalen*.

P. G. TAIT

ROYAL ENGINEER PROFESSIONAL PAPERS

Professional Papers of the Corps of Royal Engineers.

Edited by Major R. H. Vetch, R.E. Vol. VIII. 1882, 214 pp., 39 pl. (London: Stanford, 1883.)

SO many essays were contributed to these papers in 1882 that it was found necessary to publish two volumes for that year. This is a healthy sign of the interest taken by the Corps as a whole in their profession. Vol. VII. was devoted entirely to permanent fortification, a purely professional subject; whilst Vol. VIII. contains eleven papers, several of which are of general interest. This volume must have been an expensive one to get up, as it contains thirty-nine plates, some of them pretty large: the size and expense of the volume might have been considerably reduced if the contributors had prepared their plates in a more convenient shape; e.g. one

plate, a mere genealogical table, and not really a large one (Appendix I.), has eight cross folds and one longitudinal one; this could easily have been much compressed.

Paper 3 is a careful and well got up study of the "Campaigns of Lord Lake against the Marattas," 1804-6 (92 pp., with nine plates), which will be read with interest by all students of military campaigns. A good illustration of the difficulty of ascertaining the truth about events of eighty years back occurs in the verification of the site of the "battle of Delhi" (1803); the supposed site is actually marked by a pillar with inscription; but, after careful collation of contemporary surveys and reports of marches, the author decides *against the site marked by the pillar*.

Paper 8 is an interesting account of the "Triangulation of Northern Afghanistan" carried out during the late war. It is worth notice here that the introduction of the heliograph into army signalling has thrown a difficulty in the way of the use of the heliotrope for survey (in the field), from the liability of confusing the signals; but there seems little doubt that in the future the army heliograph stations could be used for the survey, and be an assistance instead of a hindrance to the survey. The general result of the altitude observations has been to throw doubt on the efficiency of the aneroid, a result much to be regretted. The refraction, which in India is about '067 of the contained arc, was found to amount to '08 of the same in the Afghan hills; an unusual result, as refraction commonly decreases with altitude.

An interesting paper (No. 9), on "Organic Compounds in the Sun," by Capt. Abney (read in 1881), gives a popular *résumé* of the subject (up to 1881), ending with the author's spectroscopic researches showing the presence of hydrocarbons in the sun and probably in space itself; this last raises curious questions as to the constitution of the ether; can space be really full of hydrocarbons? This paper has suffered rather by the delay in publication.

Perhaps the most important (military) paper is No. 10, on "Railways for Military Communications in the Field." The author shows that the early attempts at introducing railways on field service all failed to be of much practical use from their unsuitability to the conditions, the first of which is lightness and portability of both rails and rolling-stock, and it is just herein that the English railways fail most, being amongst the heaviest in the world. A light railway largely used in the United States, which has been laid at the rate of four miles a day, is favourably mentioned. After recapitulating the various schemes which have been tried or proposed, the author gives his conclusions as to the conditions for a military railway; among the most important of these are that the gauge should be $2\frac{1}{2}$ feet, the rails 10 lbs. per foot, and the line double. It is clearly impossible for any country to keep a large stock of railway plant specially for service: now it so happens that this $2\frac{1}{2}$ -foot gauge is already in use to some extent in Europe, so that the requisite plant could probably be obtained at short notice in Europe. In India, however, the metre-gauge is so largely in use that field railways in or near India will probably for many years perforce be of metre-gauge. The field railway laid for the use of the British army in South Afghanistan (1879-80) is not mentioned; this railway was laid for a great

length through a desert in hot weather at the rate of a mile a day.

The other papers in this volume are: No. 1, on "Provisional Fortification," a study of defensive works erected in a moderate time, and capable of extension and improvement, with examples from Adrianople and Tschataldscha. Paper 2, on "Graduated Arcs for Heavy Guns," contains an investigation of the errors in such arcs, and the mode of laying guns correctly, in spite of such errors. Papers 4 and 5 describe some blasting operations in Bermuda. Paper 6 describes bridges laid over the Cabul River during the war in 1879-80. Paper 7 is on "Railway Curves"; and Paper 11 contains "Tables of Ordnance Equipment."

ALLAN CUNNINGHAM

OUR BOOK SHELF

Report on the Dyes and Tans of Bengal. By Hugh W. M'Cann. (Calcutta, 1883.)

THIS Report, which is issued under the direction of the Committee of the Bengal Economic Museum, originated in the efforts made by Mr. Thomas Wardle to collect information on the modes of dyeing the silks of India. This information was asked for so far back as 1875, and although the Indian Government were fully conscious of the importance of instituting an exhaustive inquiry upon the subject, it was not until 1880 that an instalment of the General Report was issued, and from this, for reasons which it is here unnecessary to enter into, the dyes of Bengal were omitted. Dr. M'Cann has doubtless done the best he could with the materials at his command, although there is a probability that the Report would have been fuller and more free from errors had it been possible to put together the information, which was mainly collected in 1875-77, at a time when the officers of the local governments and administrations through whom the information was obtained were still resident in their respective districts. As it is, the Report is avowedly incomplete, and in many points already out of date. The classification adopted is, in the main, the same as that already employed by Mr. Liotard in the Report on "Dyes of Indian Growth and Production" above referred to, but with the difference that Dr. M'Cann has preferred to give the methods of dyeing in connection with the accounts of the dye-stuffs themselves, instead of referring them to the fabrics which are dyed by them. The dyes are classed according to the colour they afford when used singly. One disadvantage of this arrangement is that some dye-stuffs which are used both alone and also in the preparation of compound colours are mentioned several times. Many of the dye-stuffs are called simply by their vernacular names, as they have not yet been botanically identified, and in many of the cases in which the scientific name of the specimen has been given there is nothing to show how it has been arrived at. In spite, however, of these imperfections, the Report adds considerably to our knowledge of the tinctorial resources of India, although it must be stated that owing to the delay in its compilation the original object of the inquiry has been in a great measure lost sight of. The primary object of the inquiry was, in fact, to obtain data upon which to base experiments with regard to the possibility of developing and improving methods of dyeing with native Indian dyes. Dr. M'Cann expresses the hope that this project may be revived. He is of opinion that among the vast number of Indian dyes there are many that might be developed into flourishing industries; but he is equally of opinion that this development will never take place through the native dyers themselves, who are content to follow the primitive methods handed down to them by their predecessors. Dr. M'Cann

suggests that great results might follow if the Government would send out to India one or two trained chemists or scientific experts in dyeing to conduct experiments with the special object of developing native dyeing industries. The number of properly trained technical chemists already there is too small to hope for anything from them, nor is it likely that improvements will result from the private enterprise of European firms. As it seems nowadays the fashion to commend all such projects to the notice of the City Companies, it may not be out of place to draw the attention of the Worshipful Company of Dyers to the suggestion.

T.

Lehrbuch der Vergleichenden Anatomie der Wirbelthiere.
Von Prof. Dr. Robert Wiedersheim. Zweiter Theil.
(Jena, 1883.)

WE have on a previous occasion (*NATURE*, vol. xxvi. p. 385) directed attention to the first part of Prof. Wiedersheim's text-book on the "Comparative Anatomy of the Vertebrata," which was published early in 1882. He has now, by the publication of the second part, completed the work, which forms a clearly printed and profusely illustrated volume of 906 pages, with 607 well executed woodcuts. The second part comprises a description of the alimentary, respiratory, circulatory, urinary, and generative organs of the Vertebrata, and the author tells us in his preface that the entire work represents the labour of six years. In his method of treating the anatomy of the viscera, described in this part, he has followed the same lines as in Part I. The description of the modifications of each system of organs observed in the different classes of vertebrates is prefaced by a short chapter on the method of development of that system, and the subsequent description is then based on their developmental history. We can recommend the book as giving an excellent *résumé* of the subject written in a thoroughly scientific spirit.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]
[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

Evolution of the Cetacea

IN the lecture by Prof. Flower "On Whales, Past and Present, and their Probable Origin," which appeared in your columns in June and July last, he contends for the evolution of these animals from the *Ungulata*, and points to the *Zeuglodon*s of the older Tertiaries as predecessors of the *Balaenoptera*, and as representing an intermediate stage in such evolution; and he insists on the absence of cetacean remains from any Mesozoic formations as strong evidence in support of this view.

I wish therefore to inquire whether Prof. Flower has considered the evidence afforded by *Palaeocetus sedgwickii*, so named by Prof. H. G. Seeley from a set of ankylosed cervical vertebrae (one of which he figures), described by him in the *Geological Magazine* for February, 1865, p. 54.

Prof. Seeley states that the specimens were obtained from the boulder (chalky) clay near Fly, and that they were regarded both by the late Prof. Sedgwick and by himself as derived from either the Kimmeridge or the Oxford clay; and he quotes the opinion of Prof. Owen in the British Association reports, in his "British Fossil Mammals," and in his "Palaeontology," that they belonged to an animal of the Dolphin group. Prof. Seeley himself regards this animal, for the reasons he assigns, as "not a cetacean of the Dolphin family, but a true whale, its affinity with the *Balaenoptera* being, he says, singularly close"; and he concludes his description with a letter from a veteran student of the Cetacea, the late John Edward Gray, Keeper of the Zoological Department of the British Museum, who, after pointing